FEM 1.209:480537

FLOOD INSURANCE STUDY

CITY OF BALMORHEA, TEXAS
REEVES COUNTY

SEPTEMBER 16, 1988

Federal Emergency Management Agency

COMMUNITY NUMBER - 480537

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY
CITY OF BALMORHEA, REEVES COUNTY, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and updates a previous Flood Insurance Study/Flood Insurance Rate Map for the City of Balmorhea, Reeves County, Texas. This information will be used by the City of Balmorhea to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP). The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by the U. S. Department of Agriculture, Soil Conservation Service (SCS), Temple Texas Division. The hydrologic and hydraulic analyses for this updated study were also prepared by the SCS, Temple Texas Division, during the preparation of the Toyah Creek Flood Plain Management Study. The work for that study was completed in July 1986.

1.3 Coordination

On October 16, 1986, the City of Balmorhea was notified by the Federal Emergency Management Agency (FEMA) of the initiation of a Flood Insurance Study for the community.

The following organizations were contacted for any pertinent information they could provide: The City of Balmorhea; the Toyah-Limpia Soil and Water Conservation District; the Reeves County Commissioners Court; the Reeves County Water Improvement District No. 7; and the Texas Water Commission.

On November 5, 1987, a final Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA and the city to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Balmorhea, Reeves County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

Toyah Creek was studied by detailed methods for its entire length affecting the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

2.2 Community Description

The City of Balmorhea is located in the southern portion of Reeves County in western Texas. It is completely surrounded by the unincorporated areas of Reeves County. The 1980 population of Balmorhea was 568 (Reference 1).

Toyah Creek, the principal flooding source in the city, flows in a northeast direction through Balmorhea.

The climate of the area is characterized as semiarid with moderate temperatures. July has an average maximum temperature of 94 degrees Fahrenheit (^{O}F), and January has an average minimum temperature of 32^{O}F. The mean annual rainfall is 11.99 inches, and the average growing season is 226 days (Reference 2).

2.3 Principal Flood Problems

Floods from Toyah Creek damage residences, businesses, roadways, cropland, and irrigation ditches and canals. In addition to the areas affected by overbank flooding from Toyah Creek, other areas are affected by minor or nuisance flooding from local runoff water (Reference 2).

Figure 2 shows potential flood heights from Toyah Creek for the 100- and 500-year flood events.

2.4 Flood Protection Measures

There are no flood protection measures located within the community.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that

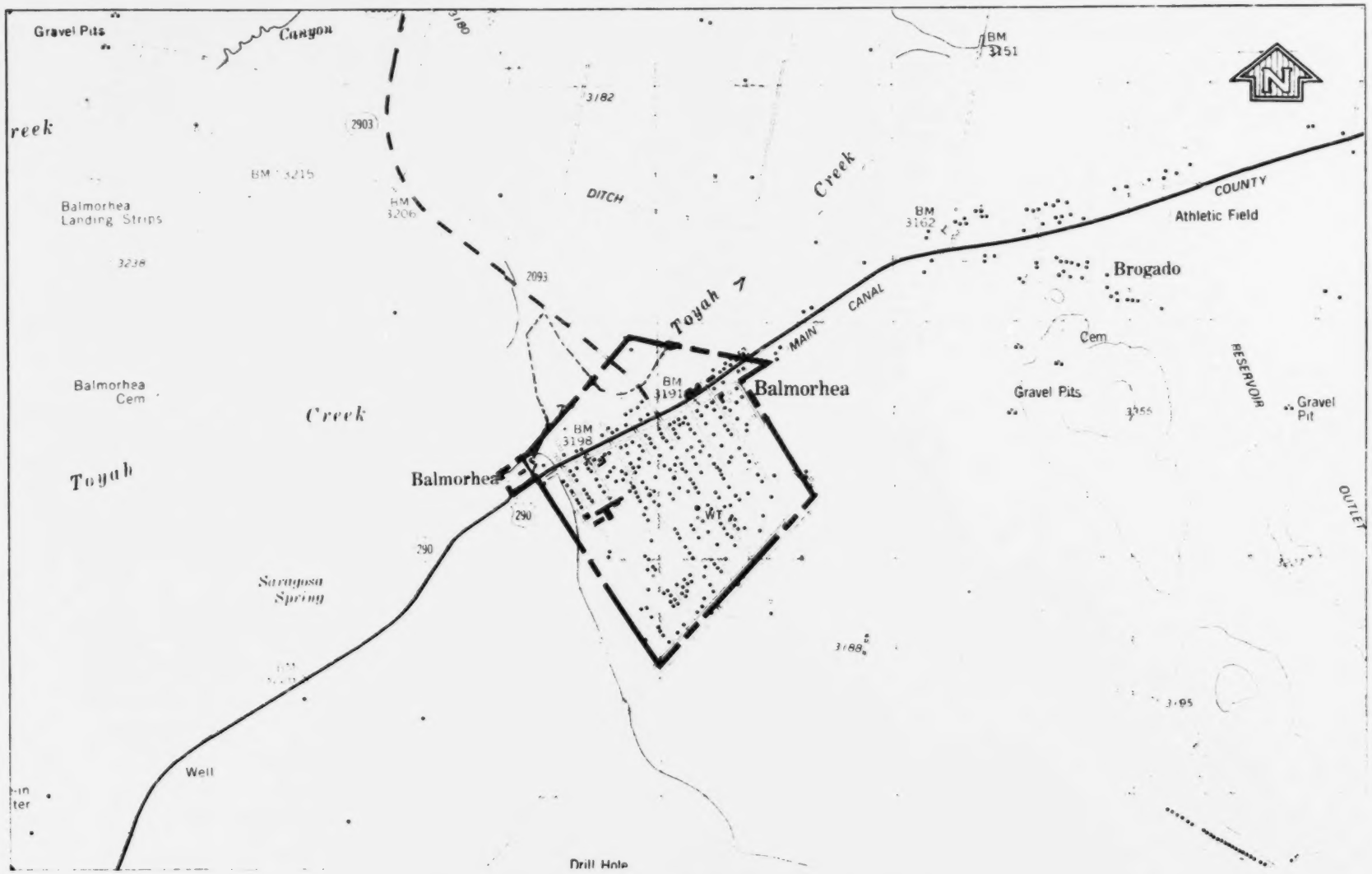


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF BALMORHEA, TX

(REEVES CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

Figure 2 - Potential 100- and 500-year flood heights from Toyah Creek in front of the SCS office on Dallas Street

are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for and 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

Rainfall frequency data for the community were obtained from the U. S. Weather Bureau Technical Paper No. 40 (Reference 3). Values greater than the 100-year frequency event were determined by extrapolation of the rainfall versus frequency graph.

Peak discharge values for Toyah Creek were determined by flood routing various storm frequencies with a 24 hour rainfall duration using the SCS Technical Release No. 20 computer program (Reference 4). The program computes surface runoff resulting from any synthetic or natural rainstorm and will route the flow through stream channels and reservoirs. Results include, but are not limited to, a combination of the routed hydrograph with those from other tributaries and a printout of the peak discharges, their time of occurrence, and the water surface elevations for each computed discharge at any desired cross section or structure.

A summary of the drainage area-peak discharge relationships for the stream studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TOYAH CREEK					
Approximately 60 feet upstream of upstream side of Fort Worth Street	280.30	44,874	68,625	82,797	111,852

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of the elevations of floods of the selected recurrence intervals.

Cross sections for Toyah Creek were field surveyed and locations were selected to represent the stream hydraulics and floodplain areas.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

Water-surface elevations of floods of the selected recurrence intervals were computed using the SCS WSP-2 computer program (Reference 5). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Toyah Creek were developed using the modified slope/area method.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevations reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using aerial photographs and topographic maps at a scale of 1:24,000 with a contour interval of 20 feet (References 6 and 7).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zone AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

No floodway is shown for Toyah Creek since floodway information was not available.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by ..ints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

There are no studies known to exist concerning flood problems in the City of Balmorhea.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201.

9.0 BIBLIOGRAPHY AND REFERENCES

1. U. S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Texas, Washington, D. C., U. S. Government Printing Office, 1981.

2. U. S. Department of Agriculture, Soil Conservation Service, Toyah Creek Flood Plain Management Study, Reeves County, Texas, Temple, Texas, July 1986.

3. U. S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Washington, D. C., 1961, Revised 1963.

4. U. S. Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Computer Program, Project Formulation, Hydrology, Washington, D. C., 1965.

5. U. S. Department of Agriculture, Soil Conservation Service, Technical Release No. 61, WSP-2 Computer Program, Washington, D. C., May 1976.

6. U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 20 Feet: Balmorhea, Texas, 1980.

7. Agricultural Conservation and Stabilization Service Flight, Aerial Photographs, January 1967.

Gould, F. W., Texas Plants - A Checklist and Ecological Summary, Texas Agricultural Experiment Station, College Station, Texas, 1975.

U. S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, 1972.

U. S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 5, Hydraulics, 1956.

U. S. Department of Agriculture, Soil Conservation Service, Preliminary Investigation of Madera Canyon Watershed, Jeff Davis County and Reeves County, Texas, Temple, Texas, (Unpublished).

U. S. Department of Agriculture, Soil Conservation Service, Soil Survey of Jeff Davis County, Texas, May 1977.

U. S. Department of Agriculture, Soil Conservation Service, Soil Survey of Reeves County, Texas, June 1980.

U. S. Department of Agriculture, Soil Conservation Service, Technical Release No. 64, Floodway Determination Computer Program, June 1978.

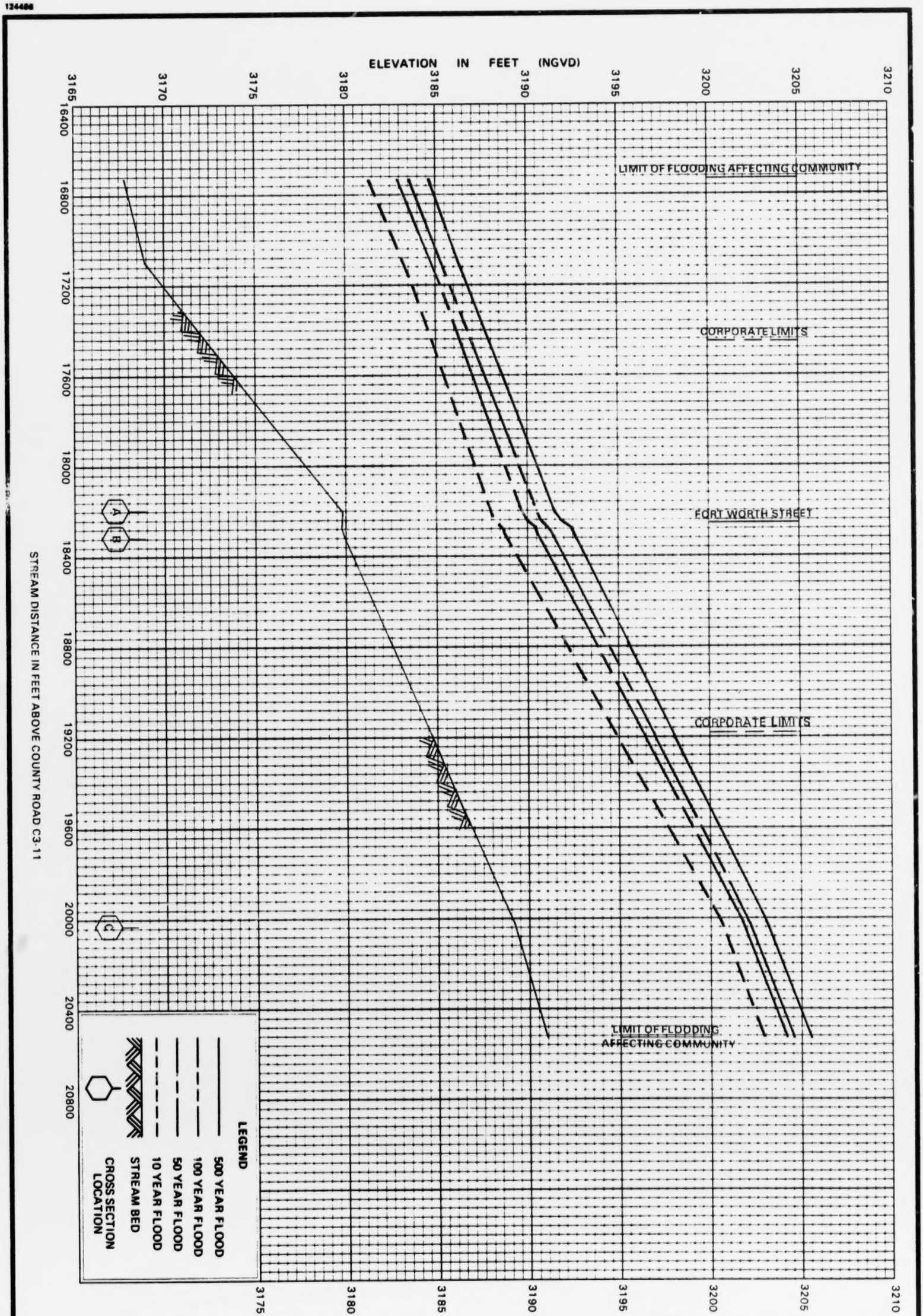
U. S. Department of Housing and Urban Development, Federal Insurance Administration, Bureau of Public Roads, Hydraulics of Bridge Waterways, September 1973, Second Edition.

Water Resources Council, Flood Hazard Evaluation Guidelines for Federal Executive Agencies, May 1972.

Water Resources Council, Regulations of Flood Hazard Areas, Volumes 1 and 2.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	3,193.54	Brass disk, stamped American Geodetic Survey 1 AG 2, approximately 0.12 mile northwest along Fort Worth Street from U. S. Route 290, at bridge on Fort Worth Street over Toyah Creek, in left end of downstream side of bridge.
RM 2	3,191.10	Standard disk, at Balmorhea, 133 feet west northwest of west corner of Post Office, in top of north corner of concrete and stone foot bridge over small pond, 41 feet southeast of centerline of U. S. Route 290 and SH-17, 49 feet southwest of 12 inch spruce tree, in small narrow park, 3 inches southwest of stone guardrail, approximately 1.5 inches above level of highway.



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF BALMORHEA, TX** (REEVES CO.)	**FLOOD PROFILES** **TOYAH CREEK**